PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :		(11) International Publication Number:
H04Q 11/00	A1	WO 99/05881
		(43) International Publication Date: 4 February 1999 (04.02.99)

(21) International Application Number: PCT/GB98/02160

(22) International Filing Date: 20 July 1998 (20.07.98)

(30) Priority Data:

08/903,227	22 July 1997 (22.07.97)	US
9804107.2	27 February 1998 (27.02.98)	GB

(71) Applicant *(for all designated States except US)*: NORTHERN TELECOM LIMITED [CA/CA]; World Trade Center of Montreal, 8th floor, 380 St. Antoine Street West, Montreal, Quebec H2Y 3Y4 (CA).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: CAVES, Keith [GB/GB]; 28 Lower Sherring Road, Sawbridgeworth, Herts CM21 9LF (GB).

(74) Agent: RYAN, John, Peter, William; Nortel Patents, London Road, Harlow, Essex CM17 9NA (GB).

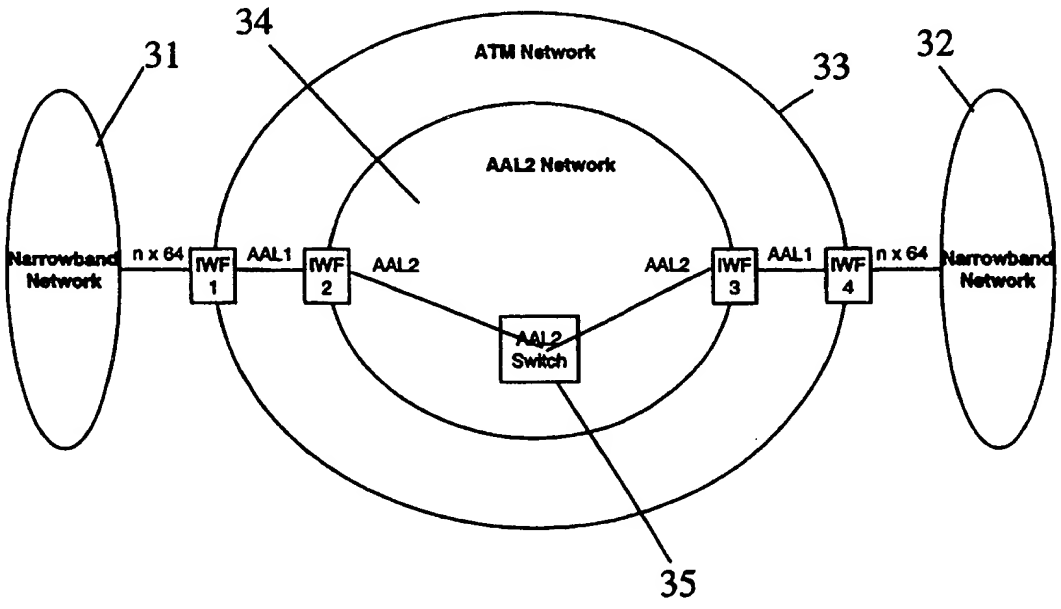
(81) Designated States: CA, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: TELECOMMUNICATIONS SYSTEM



(57) Abstract

Structured data traffic is transmitted from a first to a second narrow band network via first and second ATM networks having respective first and second adaptation layers, e.g. AAL1 and AAL2. The traffic is segmented on egress from the first ATM network encapsulated for transport across the second ATM network so as to preserve the structure information of the data traffic. The narrow band networks may be time division multiplex networks.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

TELECOMMUNICATIONS SYSTEM

This invention relates to a system and method for the transport of voice or data traffic over a telecommunications network.

BACKGROUND OF THE INVENTION

A recent innovation in telecommunications technology has been the introduction of the asynchronous transfer mode (ATM) transmission protocol. In this technique, information to be transmitted is loaded into packets or cells each of which is provided with a header containing information that is used for routing the cell to its correct destination. The header packet or cell may also contain other protocol control information relating to the cell payload and, in particular may include a cell sequence number so that cells received at a destination, possibly via different routes, may be unpacked in the correct order to recover the payload contents. The sequence number can also be used to indicate missing cells.

As the technique has developed, ATM networks have evolved to handle different types of traffic, for example narrow band voice, wide band video and low bit-rate multi-user. Each particular network traffic type is adapted to its traffic content in an ATM network by the use of an ATM adaptation layer (AAL) a number of which have been defined. For example, ATM adaptation layer type 1 (AAL-1) enables the transfer of n x 64 kbit/s structured data between source and destination whilst preserving the structure information, ATM adaptation layer type 2 (AAL-2) provides the

ability to encapsulate, multiplex and transport packets of user information inside an ATM cell stream, and so on.

With increasing volumes and variety of traffic, there is now a need for interworking between services supported by different adaptation layers. In particular, there is a need to transmit traffic across ATM networks of different types.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an arrangement and method for transmitting traffic from one ATM network to another ATM network of a different type.

It is a further object of the invention to provide an arrangement and method for transmitting traffic between narrow band networks via first and second ATM networks.

According to the invention there is provided a method of transmitting structured data traffic from a first asynchronous network to a second asynchronous network, the first and second networks having respective first and second adaptation layers, the method including segmenting the traffic on egress from the first network, and encapsulating the segmented traffic on ingress to the second network whereby to preserve the structure information of said data traffic.

According to another aspect of the invention there is provided an arrangement for transmitting structured data traffic from a first asynchronous network to a second asynchronous network, the first and second networks having respective first and second adaptation layers, the arrangement including means for segmenting the traffic on egress from the first network, and means for encapsulating the segmented traffic on ingress

to the second network whereby to preserve the structure information of said data traffic.

According to a further aspect of the invention there is provided a method of transmitting structured data traffic from a first narrow band network to a second narrow band network via an ATM network configuration comprising a first ATM network embedded within a second ATM network, the method including adapting the structured data traffic into a first format on ingress to the first ATM network and transporting the adapted data across that network, converting the adapted data into a second format for transport and switching via the second ATM network, reconverting the adapted data from the second format to the first format, transporting the adapted data to the second narrow band network via the first ATM network, and converting the formatted data back to structured data on egress from the first ATM network.

The structured data can incorporate voice signals which have been digitised and which are in e.g. a TDM format.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a schematic diagram illustrating the structure of the ATM adaptation layer 1 (AAL-1);

Figure 2 is a schematic diagram illustrating the structure of the ATM adaptation layer 2 (AAL-2);

Figure 3 shows an arrangement according to an embodiment of the invention for providing interworking between AAL1 and AAL2 networks;

Figure 4 illustrates a first method of mapping AAL1 to AAL2 in the network arrangement of figure 3; and

Figure 5 illustrates a second method of mapping AAL1 to AAL2 in the network arrangement of figure 3.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring first to figure 1 which is introduced for explanatory purposes, the ATM Adaptation Layer Type 1 (AAL1) enables the transfer of n x 64 kbit/s structured data between source and destination whilst preserving the structure information. In other words, where a repetitive frame of 'n' channels is to be transported every 125 microseconds, information indicating the start of frame is also transported so that the exact frame structure may be recovered at the destination.

Figure 1 shows the process used by AAL1 to provide the structured data transfer (SDT) capability. Frames of n x 64 kbit/s structured data arrive for transport every 125 microseconds. The example shows frames of less than 47 octets, so that consecutive octets from adjacent data structures are concatenated to form the payloads for consecutive AAL1 SAR-PDUs. For frames longer than 47 octets, the process is similar, with consecutive octets from one or two data structures being concatenated to form the payloads.

In figure 1, the following acronyms are employed:

CRC is the convergence sublayer indicator

SC is the sequence count

CRC is the cyclic redundancy check
P is the parity
Hdr is the SAR-PDU header
Ptr is the SAR-PDU pointer

The AAL1 SAR-PDU always starts with a 1-octet header containing the four fields shown. In addition, a SAR-PDU pointer field of 1-octet is inserted immediately after the Header by the transmitter once in every cycle of eight cells, but only when the sequence count value in the SAR-PDU header is even. The figure shows AAL1 SAR-PDUs containing the pointer field, located in AAL1 cells with sequence number values equal to 2 in this example. The presence of the pointer field is indicated by the value '1' carried by the CSI field of the SAR-PDU header. At all other times, i.e. for all odd values of sequence count and for even values of sequence count in non-Pointer cells, the CSI field is set to '0'. Note that the presence of the SAR-PDU pointer reduces the length of the SAR-PDU payload from 47 to 46 octets in those cells in which it appears.

The pointer is used at the first opportunity in a cycle of eight cells to indicate the first start of the structured block of n x 64 kbit/s channels following the end of the pointer field. This enables the start of the block structure to be recovered reliably at the receiver.

Referring now to figure 2 which is also introduced for explanatory purposes, the ATM Adaptation Layer Type 2 (AAL2) provides the ability to encapsulate and transport packets of user information inside an ATM cell stream. Packets from multiple users may be multiplexed onto a single ATM connection. These user packets consist, typically, of compressed voice information and vary in size from a few octets upwards, depending on the encoding algorithm in use. AAL2 permits packets of up to 45 octets to be carried by default with optional length of 64 octets. Longer packets must be

segmented in a service specific convergence sublayer (SSCS) function prior to being handed down to the common part sublayer (CPS) of AAL2.

In figure 2, PH refers to the packet header, PP to the packet payload and STF to the start field.

Figure 2 shows the sequence of operations involved in the AAL2 packet transfer process used to encapsulate user packets into an ATM cell stream. As shown, user information packets of variable length are encapsulated into SSCS-PDUs. For the majority of information packets carried by AAL2, which will be routine voice (or voice and data) packets, the SSCS function is essentially null. This type of packet is referred to as Type 1 in Figure 2 and involves no addition of SSCS packet header (SSCS-PH) to the Type 1 packet. The UUI (user to user information) field in the CPS packet header identifies the Type 1 packets by means of one or more code point values. Other packet types (e.g. Types 2, 3 and 4) are possible in which extra protocol control information and/or error protection is a requirement. Figure 2 identifies this latter type of packet as 'non-Type 1'. The resulting extra fields appear in the SSCS-PH and the corresponding packet types are again identified as such by specific code points of the CPS packet header UUI field.

Following the SSCS process, the SSCS-PDUs are then encapsulated into CPS packets by the addition of CPS packet headers. A CPS packet thus consists of a CPS packet Header (CPS-PH) and a CPS packet payload (CPS-PP). The latter field has a length of from 1 to 45 (default maximum) octets. The CPS-PH of 3 octets consists of the following 4 fields:

- CID = Channel Identifier (8 bits)
- LI = Length Indicator (6 bits)

- UUI = User-to-User Information (5 bits)
- HEC = Header Error Check (5 bits).

One or more CPS packets are concatenated and a start field (STF) plus possibly a padding field are added as shown to form the CPS-PDUs, which are the fixed length 48 octet ATM cell payloads.

Figure 3 now shows an arrangement in which information being carried on an AAL1 cell stream is converted to an AAL2 cell stream. As shown in the figure, the arrangement provides for the transfer of structured data between narrow band networks 31, 32 via concatenated 'pure' ATM (33) and AAL2-based (34) ATM networks. Typically, the narrow band networks 31 and 32 will be time division multiplex (TDM) networks carrying voice and/ or data traffic. Switching of traffic within the AAL2-based network is performed by AAL2 switch 35. At the Interworking Function (IWF 1) between the narrow band network and the ATM network, the n x 64 kbit/s structured data is adapted using the SDT (structured data transfer) mechanism of AAL1. The structured data is then transported across the ATM network to the interworking function IWF 2 located at the boundary between the ATM network 33 and the AAL2 network 34. Here, the AAL1 structured data is converted by the interworking function IWF 2 to a suitable format for transport and switching by means of AAL2. On the other side of the AAL2 network 34, at the interworking function IWF 3, the data is converted back for transport via AAL1 over the 'pure' ATM network 33 to the interworking function IWF 4. Here, the structured data is converted back to its original TDM (time division multiplex) format for transport within the destination narrow band network.

There are a number of options by which the AAL1 structured data may be converted for transport via AAL2. Two preferred options involving

segmentation of the AAL1 SAR-PDUs (segmentation and reassembly-protocol data units) are discussed below.

In this the first arrangement illustrated in figure 4, the stream of AAL1 SAR-PDUs is segmented in a simple manner and then encapsulated for transport by the AAL2 CPS. As shown in figure 4, the 48 octet AAL1 SAR-PDUs (segmentation and reassembly-protocol data units) are segmented as required to enable their formation into the maximum (default) size 45 octet AAL2 CPS packets. This entails concatenating 45 octets from one or two consecutive AAL1 SAR-PDUs and adding an AAL2 CPS (common part sublayer) header field of 3 octets to form the CPS packets. The figure shows the AAL1 segments being loaded into consecutive AAL2 packets; however, it will be appreciated that packets from other applications can be interposed in the AAL2 packet stream. This in no way affects the AAL1 segmentation process, since the any AAL2 packet carrying the AAL1 segments only carries segments from the same source. These segments are identified as such belonging to a given source by means of the unique value of the CID field carried in their AAL2 packet headers.

A requirement of the above segmentation process is that of identifying the start of a structured block of data within the AAL2 CPS packets. In AAL1, this identification is accomplished by the pointer field carried in every cycle of 8 cells as explained previously. However, the above segmentation process now causes the AAL1 SAR-PDU pointer to appear asynchronously to the start of the AAL2 packets carrying the AAL1 segments. Therefore, it is necessary to carry a further CPS pointer in the AAL2 CPS packet stream whose function is to locate the start of the AAL1 SAR-PDU pointer field. For this purpose, in addition to the Type 1 UUI code point(s) identifying routine voice (or voice and data) traffic, an extra unique UUI code point is used to signify routine traffic plus CPS pointer. The octet immediately following the CPS header carrying the new UUI codepoint is then used as

the CPS pointer which locates the SAR-PDU pointer within the CPS packet. The data structure can thus be recovered at the receiver by reference to the SAR-PDU pointer.

In a second embodiment, the stream of AAL1 SAR-PDUs is segmented such that the AAL1 SAR-PDU pointer is guaranteed to be synchronous with the start of the AAL2 CPS packets. This process is illustrated in Figure 5.

As shown in figure 5, the 48 octet AAL1 SAR-PDUs are segmented into 24 octet equal length segments. To each segment, an AAL2 CPS packet header is appended to form 27 octet long CPS packets. This segmentation process guarantees that the SAR-PDU pointer always occupies the second octet position that follows an AAL2 CPS packet header (the first octet position being occupied by the AAL1 SAR-PDU header).

Clearly, in the process of figure 5, the AAL1 SAR-PDU headers only appear in every second AAL2 CPS packet. However, the UUI fields in the CPS headers contain a sequence number of some modulus, e.g. 2 or 4 or 8 or 16. By ensuring that the SAR-PDU headers only appear in CPS packets containing even sequence numbers (or odd sequence numbers - it only matters that the transmitter and receiver both agree on which) the SAR-PDU Pointer can always be located at the receiver. This is simply a matter of identifying the SAR-PDU Headers with a CSI field carrying the value '1'. The SAR-PDU pointer is then located in the octet immediately following the header field and enables the data structure to be recovered at the receiver.

This segmentation process can be extended to segment lengths other than 24. Where the maximum AAL2 packet length is the default of 45 octets, any segment length that is a whole number divisor of 48 can be used successfully, except 48 itself (48 octet segments can be used in cases where the default maximum AAL2 packet length is 64 octets). For any

segment length created by this rule, the result is that the AAL1 SAR-PDU header appears every 'N' AAL2 CPS packets, where 'N' is the integer divisor which provides the segment length. Again, providing that the SAR-PDU headers only appear in CPS packets with even sequence numbers, the SAR-PDU pointer can be recovered at the receiver.

Recovery may be simplified by ensuring that, at the start of transmission, the SAR-PDU Header appears in the CPS packet with sequence number '0' (or some other known value of sequence number). This provides a ready index from which counting to determine the position of the SAR-PDU pointer every 'N' packets can be carried out. However, note that the case of the 48 octet segments is special - here, the SAR-PDU header appears in every CPS packet, which makes the recovery of the SAR-PDU pointer particularly straightforward.

It will be understood that although the technique has been described above with particular reference to use with the AAL1 and AAL2 adaptation layers, it is of more general application. It will also be understood that various modifications and alterations might be made by those skilled in the art without departing from the spirit and scope of the invention.

CLAIMS:

1 A method of transmitting structured data traffic from a first asynchronous network to a second asynchronous network, the first and second networks having respective first and second adaptation layers, the method including segmenting the traffic on egress from the first network, and encapsulating the segmented traffic on ingress to the second network whereby to preserve the structure information of said data traffic.

2. A method as claimed in claim1, wherein the structured data traffic is segmented into common part sublayer (CPS) packets, each said packet being provided with a header field.

3. A method as claimed in claim 2, wherein said header field comprises three octets.

4. A method as claimed in claim 3, wherein the structured data incorporates pointers, and wherein the segmentation is such that a said pointer is incorporated in every second CPS packet.

5. A method as claimed in claim 4, wherein the structured data comprises forty eight octet protocol data units, and wherein each said protocol data unit is segmented into two twenty four octet segments.

6. A method as claimed in claim 5, wherein a said pointer occupies an octet position immediately following the header

7. An arrangement for transmitting structured data traffic from a first asynchronous network to a second asynchronous network, the first and second networks having respective first and second adaptation layers, the arrangement including means for segmenting the traffic on egress from the

first network, and means for encapsulating the segmented traffic on ingress to the second network whereby to preserve the structure information of said data traffic.

8. A method of transmitting structured data traffic from a first narrow band network to a second narrow band network via an ATM network configuration comprising a first ATM network embedded within a second ATM network, the method including adapting the structured data traffic into a first format on ingress to the first ATM network and transporting the adapted data across that network, converting the adapted data into a second format for transport and switching via the second ATM network, reconverting the adapted data from the second format to the first format, transporting the adapted data to the second narrow band network via the first ATM network, and converting the formatted data back to structured data on egress from the first ATM network.

9. A method as claimed in claim 8, wherein the structured data traffic is segmented into common part sublayer (CPS) packets, each said packet being provided with a header field.

10. A method as claimed in claim 9, wherein said header field comprises three octets.

11. A method as claimed in claim 10, wherein the structured data incorporates pointers, and wherein the segmentation is such that a said pointer is incorporated in every second CPS packet.

12. A method as claimed in claim 11, wherein the structured data comprises forty eight octet protocol data units, and wherein each said protocol data unit is segmented into two twenty four octet segments.

13. A method as claimed in claim 12, wherein a said pointer occupies an octet position immediately following the header.

14. A method as claimed in claim 13, wherein said first ATM network comprises an AAL1 type network and said second ATM network comprises an AAL2 type network.

15. A method as claimed in claim 14, wherein said first and second narrow band networks are time division multiplex (TDM) networks.

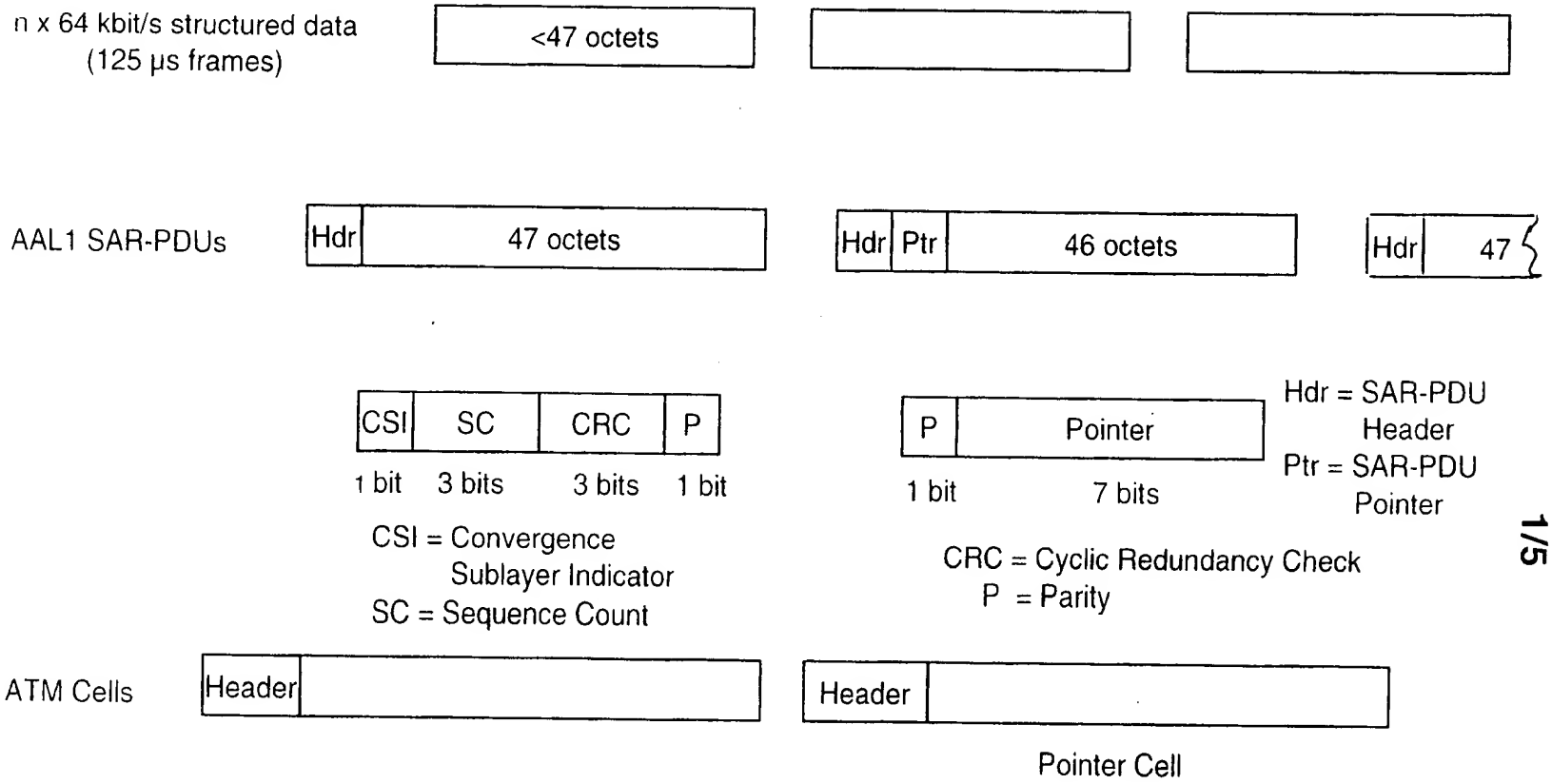


Figure 1

SUBSTITUTE SHEET (RULE 26)

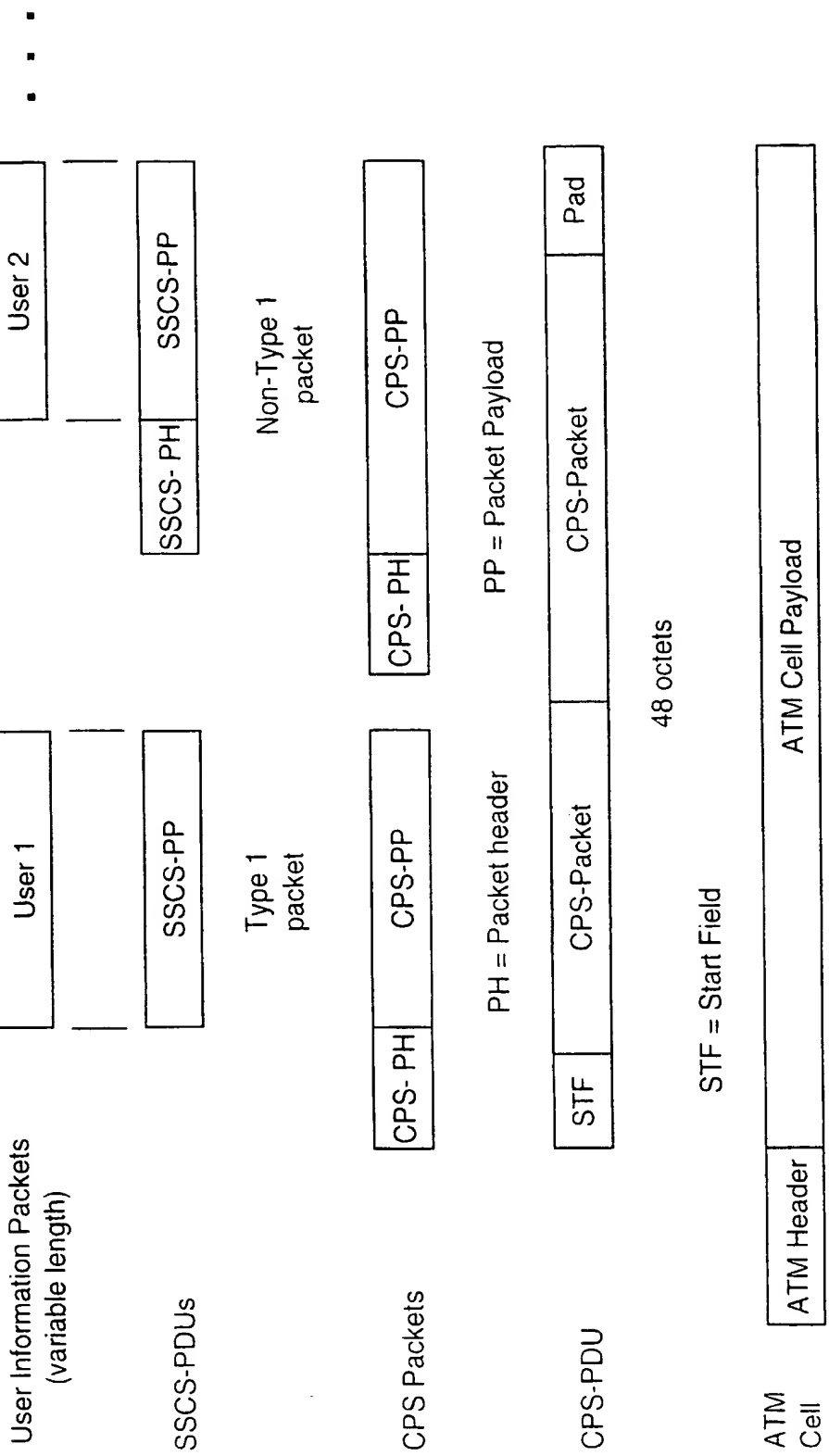

User Information Packets (variable length)
User 1
User 2
SSCS-PDUs
SSCS-PP
SSCS- PH
SSCS-PP
Type 1 packet
Non-Type 1 packet
CPS Packets
CPS- PH
CPS-PP
CPS- PH
CPS-PP
PH = Packet header
PP = Packet Payload
CPS-PDU
STF
CPS-Packet
CPS-Packet
Pad
48 octets
STF = Start Field
ATM Cell
ATM Header
ATM Cell Payload

Figure 2

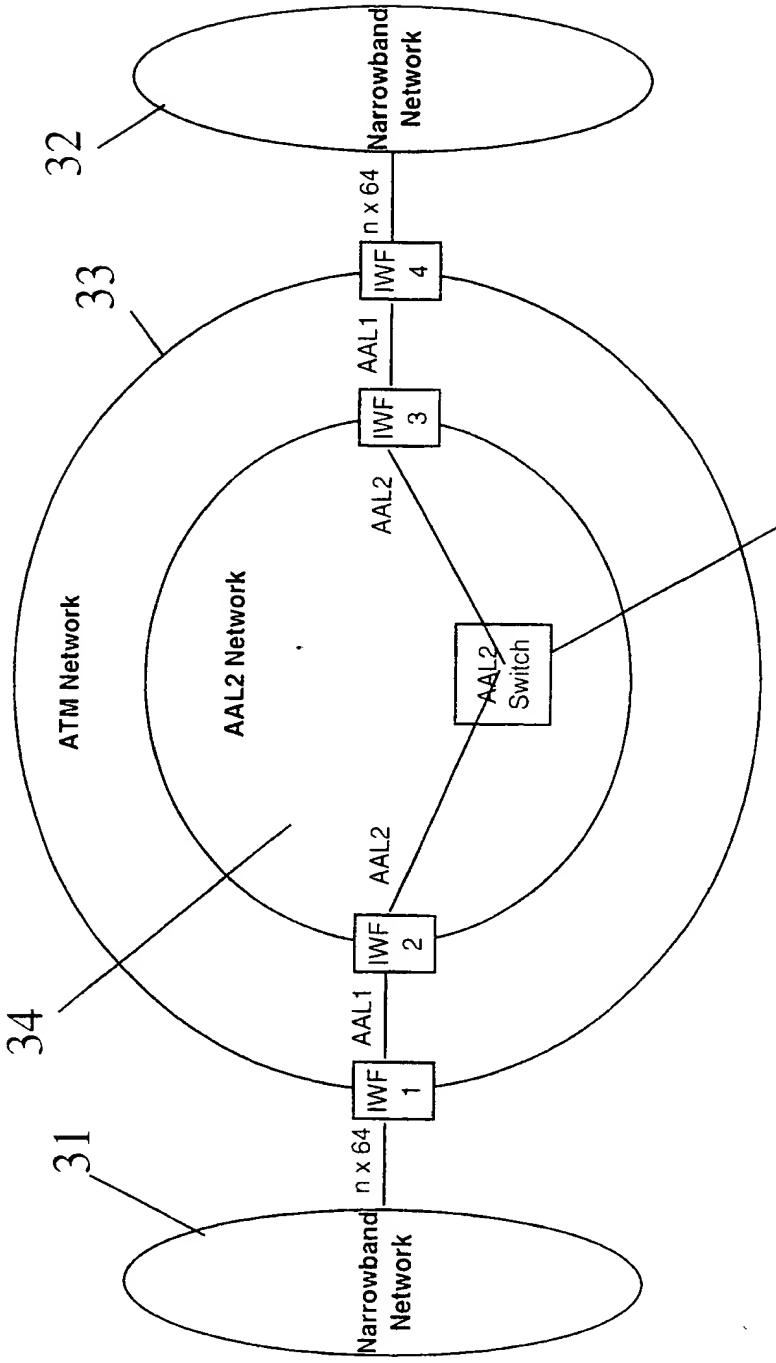

Narrowband Network
n x 64
IWF 4
AAL1
IWF 3
AAL2
AAL2 Switch
AAL2
IWF 2
AAL1
IWF 1
n x 64
Narrowband Network
ATM Network
AAL2 Network
31
32
33
34
35

Figure 3

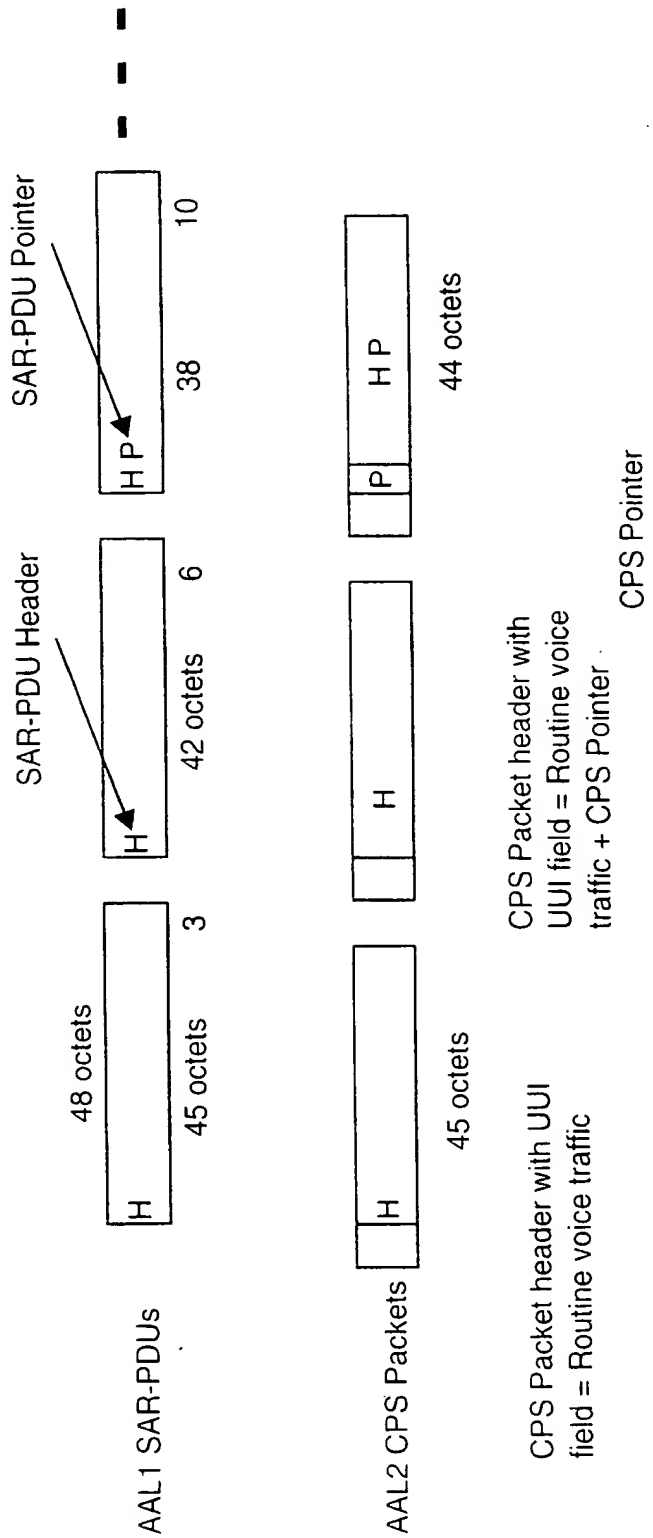

SAR-PDU Pointer
SAR-PDU Header
48 octets
45 octets
3
42 octets
6
38
10
44 octets
AAL1 SAR-PDUs
AAL2 CPS Packets
H
P
CPS Packet header with UUI field = Routine voice traffic
CPS Packet header with UUI field = Routine voice traffic + CPS Pointer
CPS Pointer

Figure 4

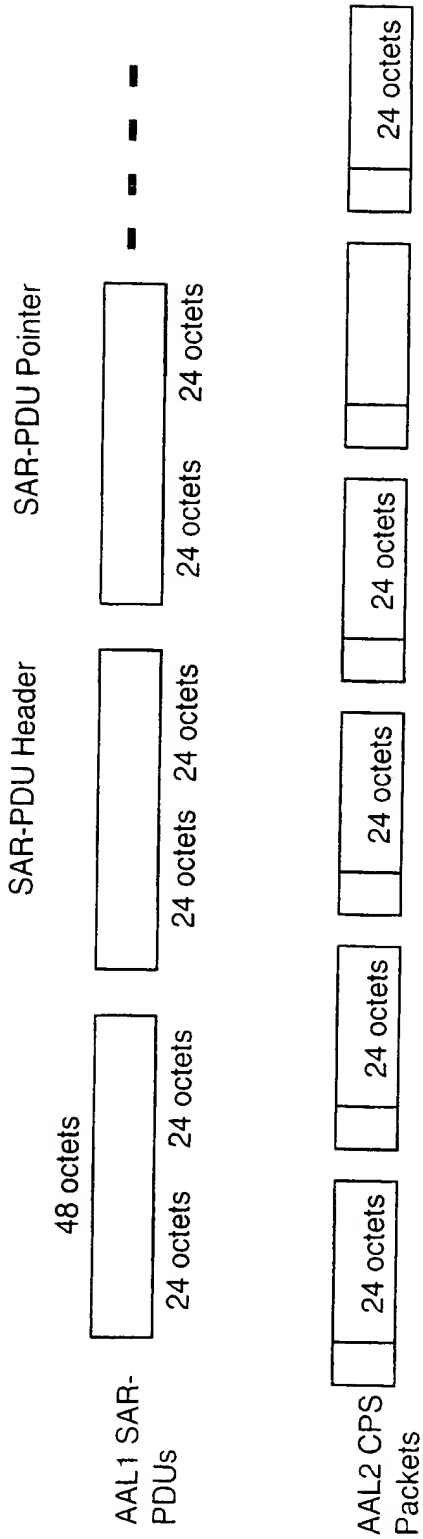

AAL1 SAR-PDUs
48 octets
24 octets
24 octets
SAR-PDU Header
24 octets
24 octets
SAR-PDU Pointer
24 octets
24 octets
AAL2 CPS Packets
24 octets
24 octets
24 octets
24 octets
24 octets
SAR-PDU Header
SAR-PDU Pointer
CPS Packet header with UUI field = Routine voice traffic

Figure 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/02160

A. CLASSIFICATION OF SUBJECT MATTER

H 04 Q 11/00

According to International Patent Classification (IPC) or to both national classification and IPC6

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H 04 J,H 04 Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5390175 A (HILLER et al.) 14 February 1995 (14.02.95), abstract, column 1, line 5 - column 5, line 15, fig. 42, claim 1. --	1
A	GB 2294840 A (GPT LTD.) 08 May 1996 (08.05.96), abstract, fig. 1, claim 1. --	1
A	GB 2299240 A (NORTHERN TELECOM LTD.) 25 September 1996 (25.09.96), abstract, claim 1. ----	1

☐ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1998	02 December 1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	GRÖSSING e.h.

Form PCT/ISA/210 (second sheet) (July 1992)

ANHANG

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

ANNEX

to the International Search Report to the International Patent Application No.

ANNEXE

au rapport de recherche international relatif à la demande de brevet international n°

PCT/GB 98/02160 SAE 201635

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsibilité de l'Office.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
US A 5390175	14-02-95	AT E 169168 AU A1 65170/94 AU B2 686150 BR A 9408313 CA AA 2178917 DE CO 69411140 EP A1 736239 EP B1 736239 JP T2 9508766 NO A 962554 NO AO 962554 NZ A 263909 SG A1 49299 WO A1 9517789 US A 5422887 US A 5461627 US A 5422888 US A 5422889 US A 5754585 CA AA 2201966 CA C 2201966 DE CO 69010366 DE T2 69010366 EP A1 390421 EP B1 390421 JP A2 2301189 JP B2 2744336 KR B1 9403552 JP A2 2257780	15-08-98 10-07-95 05-02-98 05-05-97 29-06-95 02-09-98 09-10-96 29-07-98 03-09-97 19-06-96 19-06-96 27-07-97 18-05-98 29-06-95 27-06-95 19-09-95 20-06-95 06-06-95 09-06-98 20-09-95 24-10-95 11-08-94 01-12-94 03-10-90 06-07-94 18-12-90 23-04-98 09-05-94 18-10-90
GB A1 2294840	08-05-96	AU A1 36608/95 CN A 1137203 EP A1 711259 GB AO 9422396 GB AO 9516576 ZA A 9509379	23-05-96 04-12-96 08-05-96 04-01-95 27-09-95 26-06-96
GB A1 2299240	25-09-96	EP A1 815702 GB AO 9506024 WO A1 9631080	07-01-98 10-05-95 03-10-96